DOCUMENT RESUME

ED 269 768 CS 209 682

AUTHOR Hogge, Joan Ellet
TITLE Understanding the Writing Process through Brain Hemisphere Neurology.
PUB DATE [85]
NOTE 33p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Adults; Behavior Patterns; *Brain Hemisphere Functions; *Coherence; *Learning Disabilities; Neurological Impairments; Paragraph Composition; *Writing Difficulties; Writing Exercises; Writing Improvement; *Writing Processes; *Writing Research
IDENTIFIERS *Discourse Modes

ABSTRACT

Acknowledging that ordering, spatial orientation, and synthesis are important properties in achieving clarity in writing, a study investigated the biological influences on students' writing processes and ways to help writers produce more coherent written products. Subjects, two males and four females ranging in age from 19 to 40, were tested using a modified "Symbol Language Battery," an instrument designed by neurologist Warren Weinberg to test modal writing of normally intelligent subjects with developmental disorders. The instrument required each subject to write a short paragraph of three to seven sentences in each of four modes of writing: narration, description, classification, and comparison/contrast. Subjects were given an overview of the modes as rhetorical strategies and asked to write in the modes in ascending order of difficulty in four hour-long sessions. Subjects' learning disability evaluations were also compared with a Xenon Blood Flow Study to verify the location of their deficiency and to design task-specific exercises. Subjects were then retested and reevaluated. Preliminary results indicated that Xenon pictures of subjects' brains were suggestive of subjects' surface writing problems. Improvement in the second writing samples indicated that exercises addressing particular deficiencies altered writing behavior in some subjects. (HOD)

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Joan Ellet Hogge
438 Crestover Circle
Richardson, Texas 75080
Instructor: Richland College
Phone: 231-8468

UNDERSTANDING THE WRITING PROCESS THROUGH BRAIN HEMISPHERE NEUROLOGY

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ABSTRACT

This study investigates the biological influences on a student's writing process and ways to help a writer produce a more coherent written product.

Ordering, spatial orientation, and synthesis--important properties in achieving clarity in writing--are associated with specific areas of the brain. These properties are central to modes of writing (narration, description, classification, and comparison/contrast) which are interlinking parts of a completed written product.

The symbol Language Battery, An instrument designed by neurologist Warren Weinberg was adapted to test modal writing of six normally intelligent subjects with developmental disorders. Task-specific exercises were designed for subjects' deficiencies. After instruction, subjects were retested and reevaluated.

Preliminary results indicate that Xenon pictures of subjects' brains parallel subjects' surface writing problems. Improvement in second writing samples indicates that exercises which address particular deficiencies can alter writing behavior in some subjects.

UNDERSTANDING THE WRITING PROCESS THROUGH BRAIN HEMISPHERE NEUROLOGY

During the process of writing, a writer may discover reality--the reality of his own thoughts--and ultimately the reality of his own personal views about life, his relationship with others in society and the world in which he lives. Writers can forge fantasy into fact when taught with an understanding of the subject as well as the student. As diet and exercise are interdependent in a holistic approach to health, so holistic writing requires attentiveness to a continuing process rather than a final product. In both processes self awareness and health appear as primary concerns. Some holistic writing processes center on modes: narration, description, classification and comparison/contrast. These modes truly exist only as pieces of a completed puzzle in which all the pieces interlink creating a written work; nonetheless, to improve the whole, a study of individual parts (thus the concept behind the teaching of the modes separately) can help to produce a completed product because a completed task when viewed as a series of manageable ones is more readily attempted. Solutions sought and discovered for intermediate tasks often enhance and expedite completion of a larger assignment.

Although a holistic concept of writing as a writing process frequently centers on the teaching of modes to achieve clarity in writing, the concept will indeed be holistic when expanded to include a greater understanding of the student who attempts the writing process. For example, while teaching the modes to a freshman composition class, I observed that some of the modes were difficult for certain students and not for others. While some students never experienced any difficulty with any of the modes taught, most students failed to write at least one of the modes. The mode that created the greatest hurdle for the greatest number of students was classification. A student's inability to utilize a particular mode can prevent completion of a clear, coherently written product. Janet Emig's article "The Biology of Writing: Another View of the Process," (1975) explores the relationship between the brain and writing. Her research is followed logically by an investigation of recall and its role, if any, in assessing a writer's difficulty with utilization of the modes. Her research is followed logically by an investigation of recall and its role, if any, in assessing a writer's difficulty with utilization of the modes. If each mode is dependent upon a special area of the brain and if that particular area is dysfunctional or deficient, composition teachers would benefit from ethnographic research on memory and

recall.

What is recall? How does it--or lack of it--affect writing? Often recall is confused with memory--information accumulated through experiences stored in the brain. Recent research confirms that "episodic memory refers to discrete events of past time, whereas semantic memory refers to knowledge of word meanings, rules of language, and similar types of categorical information" (Wood et al, 1980). Recall, on the other hand, is the ability to call that previously stored information to awareness. An inability to recall stored events or word meanings could seriously affect writing. Memory and recall, then, contribute to holistic writing, but each contributes in a distinct way.

Each area of the brain has its special function in the process of writing; the left hemisphere is thought to be primarily responsible for language and order while the right brain functions more holistically to spatial orientation and creative inspiration of synthesis. What happens if one, or perhaps several areas of the brain are deficient? Could deficient areas be reprogrammed? Are alternative methods necessary for some students who continually have difficulty? By evaluating the writing problems of normally intelligent subjects with developmental disorders, this ethnographic study

might help clarify the writing problems that exist. Further, it may help to understand which hemisphere of the brain governs particular writing behavior, and it may suggest how certain writing problems may be avoided altogether.

Design of Study

To obtain the broadest perspective possible from this study, I have utilized ethnographics in its design. My study involved six subjects, each of whom was tested for four hours before being instructed for eight hours. The tests were writing problems that produced samples for evaluation from which exercises were designed. Evaluation followed both testing and instruction. As a teacher/observer, I recorded the behavior of the subjects during their writing sessions. Also, I kept notes on casual conversation (and attitudes) between subjects and myself. Always, I strived to build a rapport with each to gain an understanding of individual writing processes and percieved audiences. Of particular importance to this study is the research and experience of Warren Weinberg, M.D., a neurologist at Children's Hospital, Dallas, Texas. Because of his interest in developmental learning problems, he agreed to be an advisor, to share his evaluation instrument, and to identify potential subjects.

Subjects

Potential subjects described by Weinberg as having normal intelligence but diagnosed with unique learning disorders were invited to take part in this project. I chose those who exemplified to a greater degree of severity those types of problems seen in the classroom. All chosen subjects were tested by Weinberg's Symbol Language Battery and were diagnosed according to his Lexical Paradigm--a classification system which ranks developmental specific learning disorders found in children by hemispheric location (See Figure I).

From among ten, six consented to participate in the study--two males and four females--who ranged in age from nineteen to forty. Of these six, three were students (one a PhD candidate in Anthropology); another was a teacher in the metroplex (Dallas-Ft. Worth environs); another, a fifth, was a consultant/decorator; and the last was a homemaker with a high school diploma. Although interests and backgrounds were diverse, improving writing skill was important to each subject (See Chart I).

All of the evaluations of these subjects were compared with a Xenon Blood Flow Study to verify the location of the deficiency and validate a diagnosis of the problem.

The Instrument

The instrument used in this study is adapted from the

"Phasic Writing Skills Test" in Weinberg's Symbol Language Battery, a "tool" for diagnosing developmental specific learning disorders in children. The symbol Language Battery defines ten basic skills called Symbol Skills which ultimately determine the literacy of our children. Reading, spelling, arithmetic, drawing, printing, and writing are considered the important skill tasks, while nominal recall (proper nouns), ordering, spatial orientation and verbal communication are necessary "properties" for successful completion of these tasks. Language and writing skills, a fundamental requirement for mastery of these tasks, utilize basic language symbols: letters, numbers, colors and geometric shapes. Weinberg selected uncomplicated exercises for testing, defining literacy by educational standards and explaining "normal developmental comprehension" for each task at specific age levels.

Central to the focus of this study is the "phasic writing skill" defined in The Symbol Language Battery as "answering questions and essay writing." Weinberg's instrument for evaluating this skill, three-to-seven lines telling what he/she did last night," allows the examiner to evaluate some skill taskes important to writing: letter formation, ordering (sequencing), spatial orientation, syntax, semantics, spelling, punctuation and nominal recall; it also tests for synthesis,

comprehension and content. My modified instrument required each subject to write a short paragraph in "three-to-seven sentences telling what they did last night" in each of the four modes of writing: narration, description, classification, and comparison/contrast.

Each mode utilizes a particular property which depends upon an area located in a specific hemisphere of the brain. Narration requires the ability to order events and write them in coherent sequential order--a left hemisphere property; description relies on the right hemisphere for spatial arrangement and feeling in order to create an impression with words; classification and comparison/contrast arrange and categorize through synthesis and analysis, utilizing both left and right hemispheres. During this exercise, I also evaluated communication skills for spontaneous conversation and questioning of the topic, and for comprehension and following of instructions.

Procedure

In this study, the subjects wrote the modes in ascending order of difficulty in four hour-long sessions. During the first session, I explained the purpose of the study and presented an overview of the modes as rhetorical strategies. I advised the subjects that for purposes of this study the modes

were being treated as separate components, while, in actuality, they were interrelated and interdependent. Before writing, each subject was given two sheets of paper (a ruled sheet and a lesson sheet for the final copy) and a pen. They were instructed to write their names on the ruled paper but not the final copy. In this way their writing might be authenticated, but published samples would remain anonymous. They were reminded to ask questions before writing. An evaluation of each mode was written immediately and a typed copy was returned to subjects after a brief discussion at the following session. Evaluations were always positive. Subjects were informed that organization and coherence would be evlauated, but that punctuation, grammar and spelling would not be discussed unless requested. The same procedure was followed at each sesssion: a brief individual discussion of the previously written sample; a lesson; questions; writing and observation. After completion of this evaluation phase of the study, a complete "diagnostic evaluation" of each subject was written and compared with Weinberg's lexical diagnosis and Xenon study. Subjects were divided into three groups, and exercises were developed and assigned to enhance the logical, organizational, and verbal capacity of subjects with left hemispheric difficulties (L>R group, L+R:1 group), and to

stimulate the emotional and visiospatial capacity of writers with right hemispheric difficulties (L2+R*1 group). The subjects were then tutored privately for eight hours and retested using the same instrument.

Results

Following is a brief summary of each subject after tutoring and re-testing. Each subject has been presented in a group which follows the order of the Subjects listed in Chart I. Xenon photographs of each subject, which accompanied the in-depth summaries in the original manuscript have been omitted here. These colored pictures registered the intensity of blood flow in specific areas of the brain during increased cognitive and motor activity. They documented Weinberg's diagnosis of each subject and verified the deficient areas detected by the surface writing errors in the writing samples. Preceding each summary are the characteristic errors of each group, followed by examples of exercises used to strengthen specific hemispheric deficiencies. The summaries conclude with examples of subjects' writing samples before and after the exercises.

L>RGroup

The writing of this group was characterized by messy papers, frequent mechanical and spelling errors, and transpositions of letters or numbers, which, according to

Weinberg, indicates a problem with ordering.

Exercises were developed to strengthen the left hemisphere properties of sequencing and synthesis. Examples of several exercises follow:

(1) Sequencing With Comic Strips

Doonesbury (Trudeau, 1980) comic strips were cut into sections and shuffled into random order. Subjects were instructed to reassemble the segments into a logical "story" and give the story an appropriate title. They were then given the same comic strip with the words whited out and were instructed to "write your own comic strip and give it a title."

(2) Subjects were instructed to reassemble articles from magazines and books which had been cut into individual sentences and from which all sequential words were removed. Articles were chosen which appealed to the interests of the subjects and which may have also helped to broaden their social and political awareness.

(3) The classification pyramid was taught to help develop hemispheric properties of analysis and synthesis. Subjects were given a collage of pictures from the sports page of the Dallas Morning News (1985). They were instructed to use a classification pyramid and sub-divide sports to form classes (groups of sports with similar characteristics)

and to further sub-divide by identifying the specific object that makes each sport unique. They were then asked to write a three-to-seven sentence paragraph explaining their pyramid.

Problems with ordering were different in each subject. Tom, the PhD candidate in anthropology, classified as L+R: II+I+II was capable of phasic writing. He followed directions well and had no difficulty reassemblying articles logically. Mechanical and spelling errors indicated his sequencing problem, as well as numerous uncrossed "t's" which became more frequent with stress particularly when writing in the classification and comparison/contrast modes. He admitted that when writing, it was difficult for him to "separate objects from events." By using the classification pyramid to separate similarities and differences in a class, his ability to synthesize and analyse seemed to strengthen and his writing of the classification and comparison/contrast modes improved. He continued to commit some mechanical and spelling errors, but most appeared in the modes with which he felt less confident, and may signal lack of confidence, as well as sequential dysfunction. Transcribed writing samples of his comparison/contrast paragraphs before and after the exercises follow. In his first paragraph he begins to compare and contrast but does not expand the differences between his situation and his dogs. In his final paragraph he shows that

reading or watching T.V. require little thought while talking to his wife requires being alert. Uncrossed "t's" are transcribed as "+," and spelling errors remain as written.

Tom's Writing Sample Before Exercisesb

I was +alking on the telephone inside my house while my dog was outside walking around in the backyard. At about 10:00 P.M. the phone rang as I had just entered the house. I let Greta out the back door and went into the bedroom and picked up the phone. A frind of Crystal's had called to give some instructions about taking care of his house while he was out of town. As he was talking, I heard Greta outside barking to let me know that she had enough of the out doors and wanted to be let in. Greta kept on barking so I could not ignore her any longer so I had to get off the phone and go to the back door and let her in.

Tom's Writing Sample After Exercises

Last night I did about 3 separate activities. First, I read, then I watch +elevision and last, my wife called me up from work. At first I wan+ed to do some+hing different than going back to school and studying so I decided to get relaxed. Reading and wa+ching television was nice. I didn't have to think about doing something. I could just let my brain go, either in reading some+hing or watching a par+icular program. After a friend came over and during the last part of the late

news, my wife called in from out of town and told me where she was staying. Then I had to change my brain waives from not thinking about anything in particular to making sure that I got informa+ion down. I was nice hearing from my wife, but I was still tired and some what relaxed from wa+ching T.V. So when I was on the tellephone I had to pay more attension than I did when I was wa+ching television.

Ned, a college student, was classified as L>R: 4. His phasic writing was adaquate but writing samples were filled with mechanical and spelling errors--indication of his ordering problem. He could write logical, short paragraphs, but he had difficulty reading and comprehending articles of any length; consequently, he could not reassemble such articles logically. His attention span was short, and he found it difficult to sit for long periods of time without becoming restless. After discussing hobbies and topics which might hold his interest, reading/sequencing exercises were developed to capture his interest and hold his attention while strengthening reading and sequencing skills. He enjoyed reassemblying magazine articles into logical sequential order and reported some improvement in his written school papers. His final writing samples continue to reveal numerous mechanical and spelling errors which these exercises do not attempt to address. An example of his writing

with the types of errors which reflect his sequencing problem is transcribed below.

Ned's Writing Sample

Last night was a rather bezzy night. My family and I sat down and eat dinner together. After dinner my dad and I watched a T.V. program together. Soon after my mother and I were chopping pecans and mixing dow. We were baking some chocolate chip cookies for my dad and my girl friend. As soon as we had finesh the cookies: I ran upstairs and gave my girl fiend a call. I told stacey that I had baked some cookies for her, and that she should come over. Later that night after we eat cookies and talted she left for home. Finally I desided that I was tired ahd shoud retire for the night.

L2+R1 Group

The major deficiencies of this group are spatial orientation and word meaning which are right hemisphere functions, and they are more subtle than those found in the first group. Errors are generally of three types: 1) word differentiation/definition; 2) poor synthesis of ideas or sense impressions; 3) over description. Exercises for this group were designed to stimulate sensory perception by touching objects and writing sensory descriptions of those objects; discussions were held to help them understand and differentiate the meaning of words before subjects

synthesized their perceptions into a single written idea. Examples of two exercises adapted from an unpublished monograph by Winston Weathers (Weathers, 9) follow:

1) Sensory stimulation and Description

On the table is a sack containing various objects. Draw an object from the sack--take a minute to touch it--and write the color that you feel in space #1 below. Draw out a second object from the sack, touch it, and write how that object sounds in space 2. Pick a third object from the sack, and after touching it, write how the object smells in space #3.

Under each of these dominant "sensory impressions," write five words which you feel are synonymous or related to that impression. After you have completed writing these "cluster words" we will discuss the relationship of these words to your initial impressions before you complete the remaining assignment. [Space was provided for 1, 2, and 3.]

Finally, integrate your three sensory impressions into one "picture." Write a three-to-seven sentence paragraph and give it a title.

2) Understanding Word Meaning

Make a list of synonyms for "war," "clock," and "book" in the space provided below (five to ten words). After ten minutes, we will discuss your lists. [Space was provided for lists under

War, Clock, and Book.]

After our discussion, choose one "cluster" of related words and arrange them graphically into a pattern which makes a statement or a visual poem.

Although the writing samples of the two women in the L2+R1 group showed similar difficulties, their writing styles differed. Linda's writing style was quite organized and structured, while Sue's was more "fluid" and unorganized.

Linda, the school teacher, was diagnosed L2+R*1 on Weinberg's scale. She demonstrated understanding and improvement in synthesis in the first sensory stimulation exercise. She was unable to synthesize her three sensory impressions into one focused paragraph and wrote three paragraphs relating three separate impressions. I drew a large "picture frame" on the chalk board and asked her to tell me which impression was the strongest and describe it within the frame from top to bottom. As she described the flower, her image of it "came alive" and she "saw." She became very animated, and I told her to write what she was "seeing" on her paper. Following is a transcription of her writing sample with the synthesized sensory impressions:

The Delicate Sight, Sound, and Fragrance of a
Bell-Shaped Yellow Rose

A "bell-shaped" yellow rose can have a delicate sound and fragrance. Viewing the hues of a "bell-shaped rose" is a satisfying experience. Along the inside of the bell are the deep hues of mustard and gold. Next, bright yellow is visible. On the outside, neutral shades of tan and ivory are clearly evident. Smelling the faintly delicate fragrance of a bell-shaped rose has a peaceful, calming feeling. If one listens carefully, the delicate tingling, jingling sound of a bell is noticeable. Close obsevation of a bell-shaped yellow rose can reveal its color, fragrance and sound.

Linda felt she had learned from the study and planned to use what she learned to improve her students' writing.

Also classified as L2+R*1, Sue was a consultant with excellent verbal communication skills. However, her writing samples showed evidence of a difficulty with focus (she summarized rather than described) and word choice indicating an inner vocabulary deficiency. One function of the right hemisphere is the storing of words (left) and pictures (right) concurrently. When the right cannot synchronize the picture with meaning from the left, word communication is illogical (Weinberg, 1985).

These problems remained although improvement was evident in her final description exercise, a rewrite of her

first descriptive paragraph which, was more of a summary. Transcripts of the first writing sample and final written exercise follow. Notice the use of the word "site" for "sight."

Descriptive Writing Sample

Having spent the last several days in bed with a lingering cold I have had time to do a quick study of television programing. After hours of watching insiped sit coms, inane game shows and melodramatic soap operas I began searching for mental stimulation. Jacque Cousteau provided an outlet with a special call "Snowstorm in the Jungle." It was a documentary concerning the devastating effects of cocaine farming in Africa. I saw educated, intelligent human beings now living as indigents, walking about in a cloud of euphoria after smoking as much as 100 cocaine cigarettes daily. Young teenage mothers with suckling babes in jail for attempting to smuggle small amounts of cocaine in order to feed and clothe their children were a pitiful site gaping out through prison bars. The program was provacative in the sense it made Me wonder how I might help the poor innocent children growing up in a prison with their Mothers.

Final Descriptive Paragraph

Cocaine Attracts Poverty

Cocaine farming in Africa has become a Multimillion dollar

industry which has created a Myriad number of problems for the local people. Many unmarried Mothers attempt to smuggle the Narcotic in order to earn Money to provide for their children. When caught they are sent to jail with their babies. The children are then reared within the confines of a prison.

The prison yard is littered with debris. The women walk aimlessly about the yard absently Nursing their babies. The toddlers, in their tattered clothes and bare feet, play in the soot kicking up dust. The stench of sewage and stew pots permeates the heavy air. Overhead the prison guards stand perched in their lookouts as though the pitiful, caged creatures below were dangerous criminals rather than the helpless, starving humans who need the love and understanding of their fellow Man.

Her focus greatly improved in the final paragraph, and one "sees" and can feel the oppressive atmosphere in the prison yard.

L+R: 1 Group

Errors of this group were characterized by misrepresetation of written symbols--what Weinberg calls "inner speech" deficiency. Words in the left hemisphere are not calling forth the pictoral meaning of the right hemisphere, thus logic is impaired (Weinberg, 1985). Inner speech is similar to what

linguists might term "deep Structure," and the illogical symbols emphasize the problem all conscientious writers find most difficult: clearly articulating their thoughts. Numerous mechanical errors are also obvious; in fact, punctuation is highly underdeveloped.

Deficiencies for this group were greater in the left than the right; consequently, exercises utilized pictures which subjects were forced to act out or verbally describe and thus strengthen the ability of the left hemisphere to logically express the picture in the right hemisphere. Several examples of these exercises follow.

(1) Narrating With Comic Strips

On the following sheet of paper is a Peanuts comic strip (Schultz, 1985) in which the dialogue has been "whited out." You create your own comic strip story by supplying words for each segment in logical sequence. "Talk" your story, first, and write it on scratch paper. When you have completed your writing process, write the final story on your blank copy.

(2) Composing a Narrative Comic Strip

Now that you have used actual comic strips to help create your own narrative story, I want you to write your own comic strip using the narrative paragraph you wrote at your first writing session.

First, we will review the important steps to remember when writing a narrative. Then, I want you to tell me about three events in your narrative and number them. Next, I want you to picture in your mind how you would draw event #1, #2, and #3 and how you want your story to end. Finally, in the four spaces provided on the attached sheet of paper draw your pictures and write what is happening in the box (stick figures will do). Title your comic strip "What I Did Last Night."

Although both subjects in this group had difficulty clearly representing symbols in writing, their writing differed. Karen's writing was often wordy and overly expressive, while Carol wrote simplistically and with little feeling. Both seemed to have a low tolerance for stress and tired easily. Both also seemed to write more clearly when they drew pictures first and wrote captions or stories which captured their drawings.

Karen, a Jr. College student, was diagnosed L+R:1 on Weinberg's lexical scale. She could verbalize her ideas moderately well and was interested in becoming a design consultant. However, her writing was completely unintelligible. Her motivation was low and improvement in her writing samples was minimal, although her sequencing seemed more logical and she showed she had learned the importance of titling a work.

Transcriptions of her narrative writing samples before and

after the exercises follow. In her first narrative the sequence began with her going to the store with her brother. Then, she discussed her job, and reported that her brother picked her up and they drove around in his car. She then departed from the narrative sequence and discussed her dog and school. In her final narrative, her sequencing seemed slightly more focused and she titled her work.

Karen's Writing Sample Before Exericses

I got up the semene and when store with my brother. I wen out for lunch and have fun. My friends and I went to a show and laugh at it. Then I went to work least night with my friends and we have a great time at work it is fun to see my friends Have fun at work. Is because we like whoe we are do up that so I talk to them at said are how can in on Sunday to take inlvery that so yes we are come in to help and person. Then my brother can to up me up for work we drive around the boance we hair the mauic up least so the nigot can her it. I have a greast time went my little dog that I got for grautionin why least may. I am have fun at collage I go to Ranland and it was fun to me it because this is my first years to go to collage I love to go to see new frilen.

Karen's Writing Sample After the Exercises

the serme

Saurday the steam can by and the linght went out at Marshall's so we sepent leate then we hate to go out of the store. So at 9:15 we kick over boby out of the store so we can come home. My hole famly came to get me so the light were out at of so people did not stop at the light. Same one can have a accinde up them you hate to was ever kineme.

Carol, a high school graduate and housewife was also classified as L+R: 1 on the lexical scale. Because she was hesitant to write in a group, I tested and tutored Carol at home. She was quite motivated "because she wanted to write letters to her sister so she could understand her" and asked for copies of all the exercises expressing and interest in further improving her written communication skills.

Transcriptions of her descriptive paragraphs before and after the exercise follow. Her first paragraph was an emotionless narrative report with little focus. In her final paragraph, although she did not mention what animal she was describing, her "picture" was static, and she attempted many new words in her writing vocabulary.

Carol's Writing Sample Before Exercises

I watched my cats played in the middle of the living room. Later on I then played with them. Because they are the pretties little cats you ever saw. After I got through playing with my

cats I gave them a bath. After that I called my parents to see what thay were up to. And they were not home.

Carol's Writing Sample After Exercises

His head is around and his ears are snile and his eyes are ovel they are Brown and he has a smile forhead. His nose is medium his lips are Black and his chine is smile. his wiskers are the same cloro as his fur and his paws a great big. And his fur is short and fuzzies.

Results

The preliminary results from this study corroborate Weinberg's hypothesis that errors in punctuation, spelling and grammar are signs of difficulty with ordering. From the results of this study, it appears that these mechanical errors are most obvious in writing samples of subjects within the L>R and L+R: 1 groups in which the left hemisphere dificiency is greater than the right.

The writing of the subjects in the L2+R*1 group, in which the greater areas of deficiency are contained in the right hemisphere, are less affected by mechanical errors, and demonstrate ability to write sequentially; however, difficulty with word differentiation and excessive description is found in samples of this group.

Even though the exercise time was limited, the second

writing samples show improvement in some subjects while other subjects show little or no improvement after the exercises. Evidence is encouraging and indicates a need for further research. Nonetheless, this study indicates that Xenon bloodflow studies parallel the surface writing problems of subjects and that exercises that address particular dificiencies can alter writing behavior in some writers.

Of particular interest to teachers would be the information that certain types of surface writing errors might signal a particular hemispheric deficiency which could be minimized with particular exercises, and that certain mechanical and spelling errors can not be improved by memorization. Increased understanding of a child's difficulty could lower the frustration of the teacher and decrease the stress level of the student. Also important would be the increased awareness that each child learns by a different means (kinesthetically, verbally, visually, and auditorily), and that all available modes of learning--from multi-media to technological--are important learning tools in the classroom.

CHART I

SUBJECT	CLASSIFICATION	BACKGROUND	ATTITUDE
TOM:	L>R: 2+I+II	PhD student	Anlytical/ involved
NED:	L>R: 4	Jr. College student	Polite/ Masked hostilty
LINDA:	L2+R*1	School Teacher	Enthusiastic/ Appreciative
SUE:	L2+R*1	Design/Business consultant	Outgoing/ Helpful
KAREN:	L+R:1	Jr. College student	Shy though friendly
CAROL:	L+R:1	High School Grad/ Married	Hesitant to write in group

Chart IA summarizes salient features of participants in this study. Each name is followed by Weinberg's lexical diagnosis: left (L); left greater than right (R); and left plus/minus right (L+/-R). Samples of writing corroborate his medical diagnosis.

CHART I (Continued)

SUBJECT	PERSONAL HABITS	GOAL	DEFICITS
Tom:	Thorough/ Accurate	Wants to publish	Sequencing/ Synthesis
Ned:	Persistent/ Neat	Computer Technician	Punct./ Spelling Syntax/Reading
Linda:	Organized/ Fastidious	To help her students	"Inner vocab." impairment
Sue:	Dramatic/ Organized	Wants to write a book	"Inner vocab." impairment/ Hyper-prosody
Karen:	Tires easily Reacts to Stress	To be a dress designer	Poor syntact. Word rep.
Carol:	Motivated/ Tenacious	To write letters	Poor syntact. Word rep.

The categories labeled "Background," "Attitude," "Personal Habits," "Goals," and "Deficit," highlight traits/interests which may affect writing.

FIGURE I

LEXICAL PARADIGM FOR DEVELOPMENTAL SPECIFIC LEARNING DISORDERS: RELATIONSHIP OF SPECIFIC DEFICIT TO CEREBRAL LOCALIZATION AND CLINICAL SYNDROME

Lexical-Language Type by Hemispheric Involvement

LEGEND

■ = Deficit S = Substitutions of Phonemes V = Variable V G/M = Variable "Grotesque/Messy"

O = Omissions of Phonemes T = Transpositions of Phonemes ±N = Iterative Number Tasks Writes = Variable "Minima"

* = "Seeing the world (& acting) as a series of inter-related entities"

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